CONAXIS – VERIFICATION

De Leeuw's problem

A cylindrical soil sample, which has the diameter *2a*, is constrained by two plates on the top and the bottom (Fig. 1). The sample is loaded by a uniform pressure *q* at the outer boundary, which is also the drained boundary. At the beginning, the initial pore pressure is p_0. The excess pore pressure at position *r (m)* and the time *t (s)* is calculated as[1]:

$$p = p_0 \sum_{j=1}^{\infty} \frac{J_0\left(\xi_j\right) - J_0\left(\xi_j r / a\right)}{\left(1 - m_c \xi_j^2 - 1/4m_c\right) J_0\left(\xi\right)} \exp\left(-\xi_j^2 c_v t / a^2\right) \quad (1)$$

where J_0, J_1 is the Bessel function of the first kind zero order and first order.

The parameter $\eta = \frac{1-\upsilon}{1-2\upsilon}$; The parameter $m_c = \frac{1}{2}\eta \frac{\alpha^2 + S\left(K + \frac{1}{3}G\right)}{\alpha^2}$; ξ_j for *j=1,2,3…* are the roots of function: $J_1\left(\xi_j\right) = 2m_c \xi J_0\left(\xi_j\right)$.

Parameters for the verified case are: the bulk modulus *K=500 (kN/m2);* the Biot's coefficient $\alpha = 1$*;* the Poisson's ratio $\upsilon = 0.1$; the hydraulic conductivity $k_r = k_v = 1e-9\ (m/s)$*;* the model radius *a=1.0 (m);* the model height *H=1 (m).* The difference between numerical results and analytical solutions is trivial (Fig. 1).

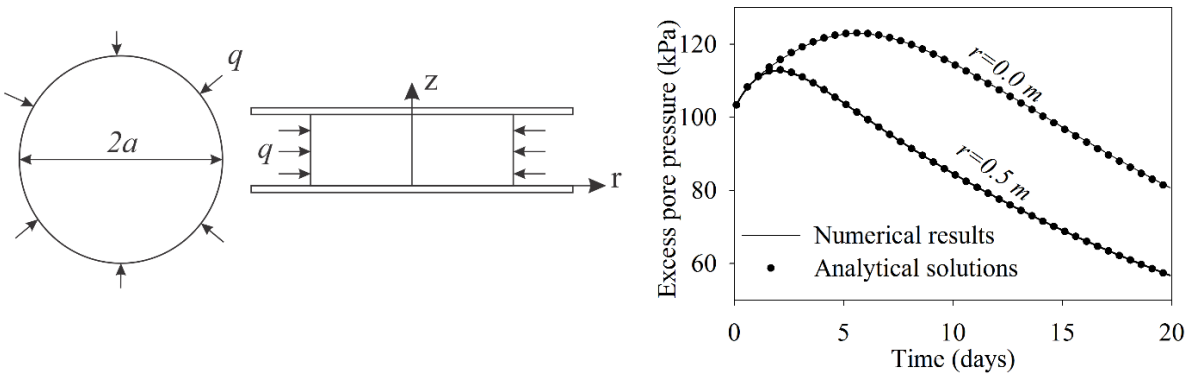

Fig. 1: Verification of De Leeuw's problem

References

[1] Verruijt A. PoroElasticity: http://geo.verruijt.net/, 2016.